Appendix E: Example PC ECONPACK Reports

PC ECONPACK is a unique economic analysis computer package available to engineers, economists, master planners, accountants, project managers, and other personnel throughout the Department of Defense (DoD). PC ECONPACK is a comprehensive program incorporating economic analysis calculations, documentation, and reporting capabilities.

It is structured so it can be used by non-economists to prepare complete, properly documented economic analyses (EAs) in support of DoD funding requests. PC ECONPACK is menu-driven and features interactive display screens which enable the user to select analysis parameters and specify functions. The user simply enters in the information, and PC ECONPACK does the rest.

PC ECONPACK's analytic capabilities are generic, providing standardized economic analysis methodologies and calculations to evaluate a broad range of capital investment categories such as barracks, hospitals, family housing, information systems, utility plants, maintenance facilities, ranges, runways, and equipment. The program performs standardized life-cycle cost calculations such as **net present value, equivalent uniform annual cost, savings-to-investment ratio, and discounted payback period.**

Cost sensitivity analysis and **discount rate sensitivity analysis** features and **graphics capabilities** are also provided by the program. Text entry is permitted for the discussion of assumptions, alternative definitions, cost derivations, results and recommendations, and non-monetary benefits. The output reports conform to current DoD guidance.

PC ECONPACK was developed by the Construction Engineering Research laboratory (USACERL) under the sponsorship of Headquarters, U.S. Army Corps of Engineers (HQUSACE). Further information about the system can be obtained from:

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FILENAME: ULTIMA
DATE GENERATED: 28 AUG 1994
TIME GENERATED: 14:06:53
VERSION: PC V4.0

E X E C U T I V E S U M M A R Y R E P O R T PAGE 001

PROJECT TITLE : ULTIMA
DISCOUNT RATE : 2.50%
PERIOD OF ANALYSIS: 7 YEARS
START YEAR : 1999
BASE YEAR : 1999

PROJECT OBJECTIVE : To provide Corps financial managers with the capability to connect to network analysis centers and the Corps financial management databases.

ALTERNATIVES CONSIDERED FOR THIS ANALYSIS:

1. STATUS QUO: 70 DIFFERENT SYSTEMS: Currently, every financial management department in the Corps has its own financial management system. There are about 70 different Windows systems in use, but none are programmed to interface with network analysis centers or Corps databases. All transferring, processing, and storage of data is done by a team of contractors who first collect the needed data from each system, and then process it themselves.

2. ULTIMA SYSTEM IN ADA: The Corps would have a contractor design, implement, and maintain a financial management system called ULTIMA. Under this alternative, ULTIMA would be developed in Ada, and the government would own the code. The system would be able to interface with other information systems, as well as the various Corps databases. All enhancements, maintenance, support, and project administration would be provided by the contractor.

3. COMMERCIAL-OFF-THE-SHELF SYSTEM: A financial management software system would be purchased from the private sector and used as the Corps standard for financial management. The vendor's purchase price would include an unlimited site license for all Corps users. The Corps would, however, contract out to program the interfaces. A contractor would also provide all maintenance, support, and administration for the system.

4. ULTIMA SYSTEM IN C++: The Corps would have a private contractor design, implement, and maintain a financial management system called ULTIMA. Unlike the ULTIMA Ada alternative, however, the ULTIMA system would be developed in C++. The system would also be able to interface with other information systems, as well as the various Corps databases. All enhancements, maintenance, support, and project administration would be provided by the contractor. The government would also own the code.

ASSUMPTIONS OF THE ANALYSIS:

1. The start year is 1999.

E X E C U T I V E S U M M A R Y R E P O R T PAGE 002

ASSUMPTIONS OF THE ANALYSIS (cont.):

2. The real discount rate used in this analysis is 2.4%.

3. Lead time (period extending from the expenditure of funds to the complete deployment of the system) is two years.

4. The economic life of the alternatives is five years; thus, there are no residual values associated with the alternatives.

5. Personnel and workload are expected to remain constant over the period of analysis.

6. Software application upgrades for the Commercial-Off-The-Shelf (COTS) Alternative is required in the year 2003.

7. All costs were derived and estimated in 1999 dollars.

8. All costs were included in the analysis to represent the total outlays and total net present values of each alternative.

9. Each package, if selected, will become the Corps standard.

10. All Corps employees have Windows installed on their computers.

11. A significant portion of the programming costs for the ULTIMA system will come from software enhancements, due to expected system expansion and capability upgrades.

RESULTS AND RECOMMENDATIONS:

ALTERNATIVE NAME	NPV	EUAC	SIR	DPP
1 Status Quo: 70 Diffe	$4,103,806	$638,399		
2 ULTIMA in Ada	$2,246,927	$349,537	2.55	2.0 YEARS
3 Commercial Off-The-S	$2,591,653	$403,164	1.61	4.2 YEARS
4 ULTIMA in C++	$2,642,885	$411,134	2.06	2.4 YEARS

NON-MONETARY BENEFITS:

The primary benefit of ULTIMA is that the government would own the code. This would allow the government to make any enhancements and adjustments to the system in a quick, responsive manner. The less time spent on making changes to the system equates to less down time.

DISCUSSION:

Costs and benefits were analyzed over a 7-year period. Annual costs were discounted at a 2.5 percent rate, and then totalled to arrive at a net present value (NPV). The least-cost alternative is the ULTIMA Ada (Alternative 2), with a NPV of $2.25M, a savings-to-investment ratio (SIR) of 2.55, and a discounted payback period (DPP) of 2.0 years.

The ULTIMA C++ option ($2.64M), the COTS ($2.59M) option, and the

E X E C U T I V E S U M M A R Y R E P O R T PAGE 003

DISCUSSION (cont.):

Status Quo ($4.10M) are $390K, $334K, and $1.85M more than the ULTIMA Ada alternative, respectively. Thus, the government would need $390K more (in present value terms, invested at 2.5%) to finance the ULTIMA C++ alternative, $334K more for the COTS alternative, and $1.85M more for the Status Quo.

In the first cost sensitivity analysis test, the cost of Ada software enhancements was varied to see if a change of rankings would result between the Ada option (#2) and the C++ option (#4). The results show that for the C++ alternative to be ranked least cost, the Ada software enhancements cost must increase by more than 42.07%. Since this is unlikely, the ULTIMA Ada option is insensitive to changes in the software enhancements cost.

Similarly, the cost of Ada software enhancements was varied to see if a change of rankings would result between the Ada option (#2) and the COTS option (#3). For the COTS option to be ranked least cost, the Ada software enhancements cost must increase by more than 36.62%. Once again, the Ada option is insensitive to changes in this cost.

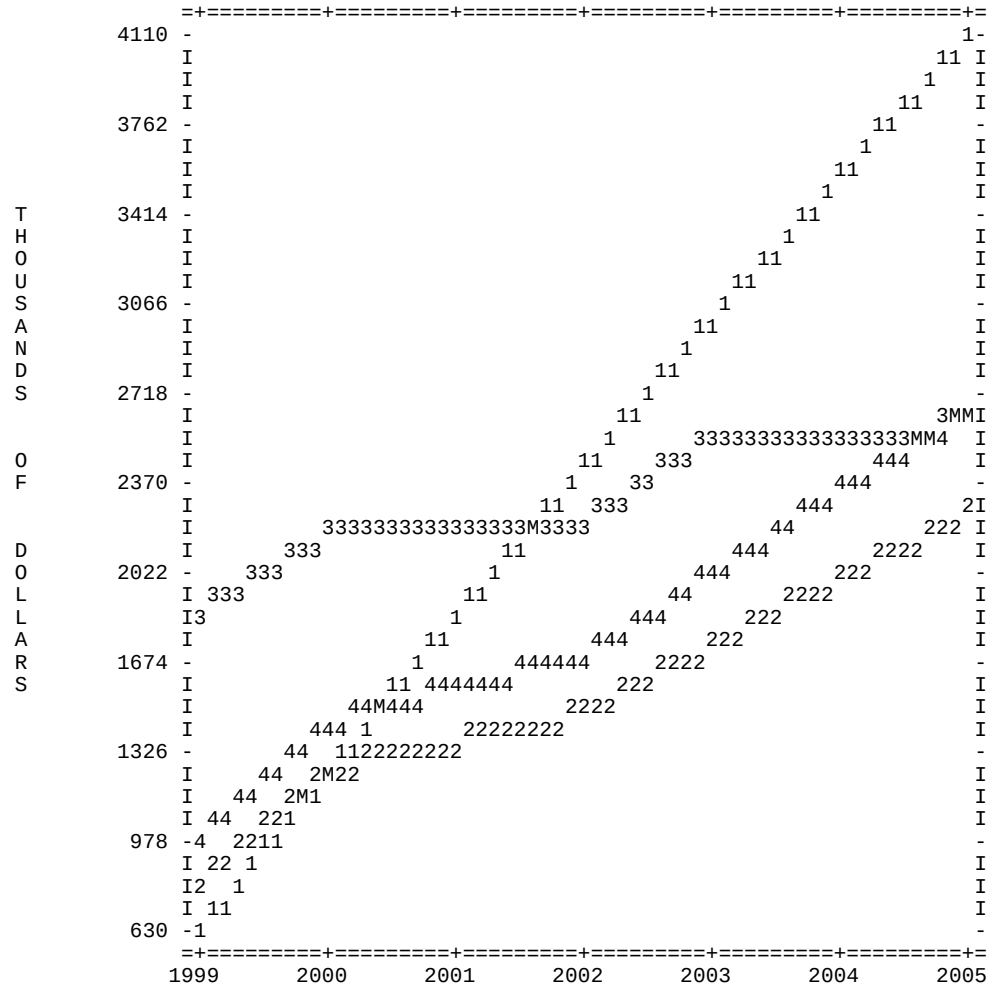
A discount rate sensitivity analysis was performed as well, varying the discount rate from 1.88 to 3.13 percent. The rankings remained the same throughout the range, with ULTIMA Ada being the least cost alternative.

Based on the NPV, SIR, DPP, and sensitivity test results, the least-cost alternative to meet this requirement is the ULTIMA Ada option, and is recommended for funding. Moreover, the ULTIMA Ada alternative would provide the government the added benefit of owning the code, which will result in responsive changes to the system, less down time, and unlimited government distribution.

ACTION OFFICER: Howe Y. E, Project Manager, (123) 456-7890
ORGANIZATION : HQUSACE

E C O N O M I C A N A L Y S I S G R A P H 1

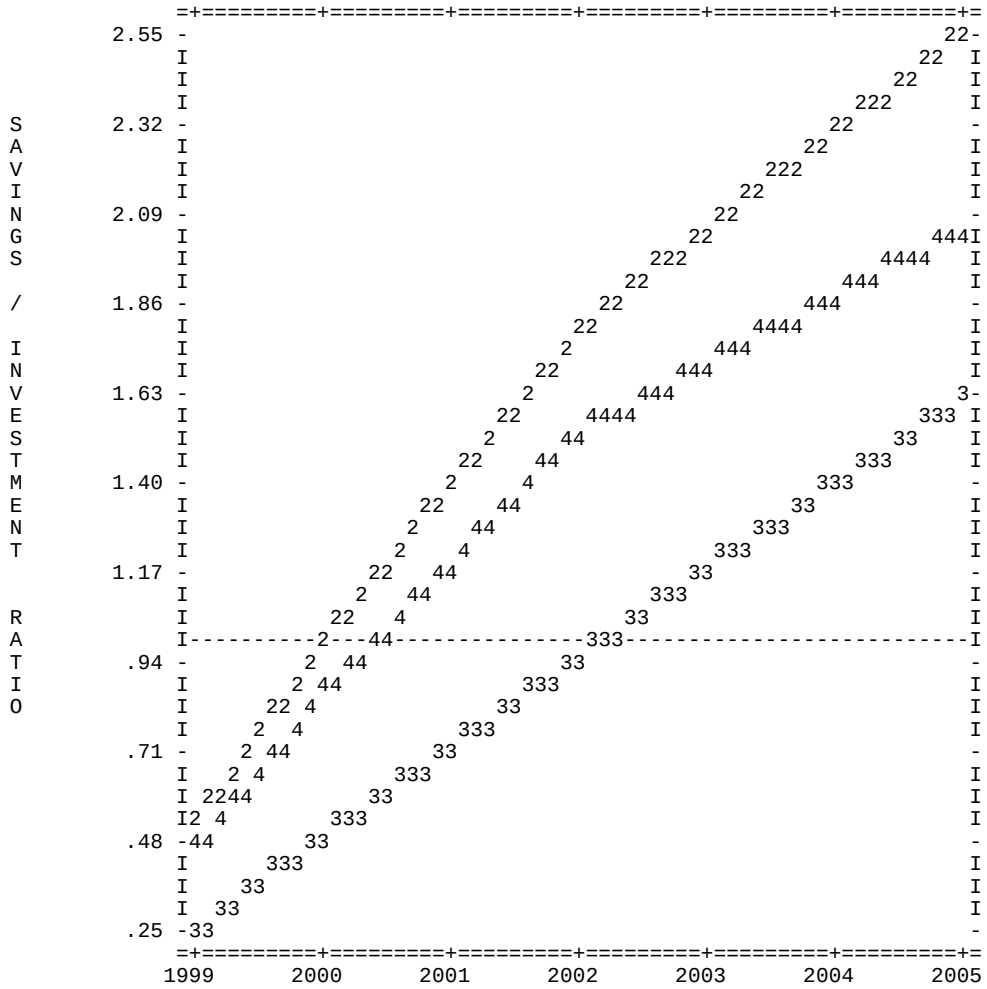
CUMULATIVE NET PRESENT VALUE



LEGEND	DESCRIPTION	LEGEND	DESCRIPTION
1	Status Quo: 70 Diffe	M	MERGING DATA
2	ULTIMA in Ada		
3	Commercial Off-The-S		
4	ULTIMA in C++		

S I R E C O N O M I C A N A L Y S I S G R A P H 1

SIR VS. YEARS



LEGEND	DESCRIPTION
2	ULTIMA in Ada
3	Commercial Off-The-S
4	ULTIMA in C++

L I F E C Y C L E C O S T R E P O R T PAGE 001

ALTERNATIVE 1: Status Quo: 70 Different Systems

YEAR	Database Maintenance (01)	Project Admin. (02)	Operations Support (03)	TOTAL ANNUAL OUTLAYS	MIDDLE OF YEAR DISCOUNT FACTORS
1999	$12,000	$6,400	$620,000	$638,400	0.988
2000	$12,000	$6,400	$620,000	$638,400	0.964
2001	$12,000	$6,400	$620,000	$638,400	0.940
2002	$12,000	$6,400	$620,000	$638,400	0.917
2003	$12,000	$6,400	$620,000	$638,400	0.895
2004	$12,000	$6,400	$620,000	$638,400	0.873
2005	$12,000	$6,400	$620,000	$638,400	0.852
%NPV	1.88	1.00	97.12		
	$77,140	$41,140	$3,985,526		
DISCOUNTING CONVENTION	M-O-Y	M-O-Y	M-O-Y		

YEAR	PRESENT VALUE	CUMULATIVE NET PRESENT VALUE
1999	$630,566	$630,566
2000	$615,187	$1,245,753
2001	$600,183	$1,845,936
2002	$585,543	$2,431,479
2003	$571,262	$3,002,741
2004	$557,329	$3,560,070
2005	$543,736	$4,103,806

EQUIVALENT UNIFORM ANNUAL COST = $638,399 (2.50% DISCOUNT RATE, 7 YEARS)

L I F E C Y C L E C O S T R E P O R T PAGE 002

ALTERNATIVE 2: ULTIMA in Ada

YEAR	Software Development (01)	Develop Data Interfaces (02)	System Deployment (03)	Hotline Support (04)	Software Maintenance (05)
1999	$800,000	$35,000	$0	$0	$0
2000	$200,000	$35,000	$150,000	$0	$0
2001	$0	$0	$0	$6,500	$5,300
2002	$0	$0	$0	$6,500	$5,300
2003	$0	$0	$0	$6,500	$5,300
2004	$0	$0	$0	$6,500	$5,300
2005	$0	$0	$0	$6,500	$5,300
%NPV	43.74	3.04	6.43	1.30	1.06
	$982,912	$68,298	$144,546	$29,100	$23,728
DISCOUNTING CONVENTION	M-O-Y	M-O-Y	M-O-Y	M-O-Y	M-O-Y

YEAR	Software Enhancements (06)	Database Maintenance (07)	Project Admin. (08)	TOTAL ANNUAL OUTLAYS	MIDDLE OF YEAR DISCOUNT FACTORS
1999	$0	$0	$0	$835,000	0.988
2000	$37,679	$12,000	$4,500	$439,179	0.964
2001	$102,542	$6,000	$3,200	$123,542	0.940
2002	$102,542	$6,000	$3,200	$123,542	0.917
2003	$272,753	$6,000	$3,200	$293,753	0.895
2004	$272,753	$6,000	$3,200	$293,753	0.873
2005	$272,753	$6,000	$3,200	$293,753	0.852
%NPV	41.89	1.71	0.83		
	$941,257	$38,425	$18,661		
DISCOUNTING CONVENTION	M-O-Y	M-O-Y	M-O-Y		

L I F E C Y C L E C O S T R E P O R T PAGE 003

ALTERNATIVE 2: ULTIMA in Ada

YEAR	PRESENT VALUE	CUMULATIVE NET PRESENT VALUE
1999	$824,755	$824,755
2000	$423,210	$1,247,965
2001	$116,146	$1,364,111
2002	$113,313	$1,477,424
2003	$262,860	$1,740,284
2004	$256,450	$1,996,734
2005	$250,193	$2,246,927

EQUIVALENT UNIFORM ANNUAL COST = $349,537 (2.50% DISCOUNT RATE, 7 YEARS)

L I F E C Y C L E C O S T R E P O R T PAGE 004

PRIMARY ECONOMIC ANALYSIS

Present Alternative: Status Quo: 70 Diffe
Proposed Alternative: ULTIMA in Ada

Project Year(s)	Recurring Annual Operating Costs Present Alternative	Recurring Annual Operating Costs Proposed Alternative	Differential Cost	Present Value Factor	Present Value of Differential Cost
1999	$638,400	$0	$638,400	0.988	$630,566
2000	$638,400	$54,179	$584,221	0.964	$562,978
2001	$638,400	$123,542	$514,858	0.940	$484,037
2002	$638,400	$123,542	$514,858	0.917	$472,230
2003	$638,400	$293,753	$344,647	0.895	$308,402
2004	$638,400	$293,753	$344,647	0.873	$300,879
2005	$638,400	$293,753	$344,647	0.852	$293,543
Totals	$4,468,800	$1,182,522	$3,286,278		$3,052,635

Total present value of investment	$1,195,756
Plus: present value of existing assets to be used	$0
Less: present value of existing assets replaced	$0
Less: present value of terminal value of alternative	$0
Total present value of net investment	$1,195,756
Total present value of differential costs	$3,052,635
Plus: present value of cost of refurbishment or modification eliminated	$0
Less: status quo salvage value	$0
Total present value of savings	$3,052,635
Savings/Investment ratio	2.55
Discounted Payback Period	2.0 years

For Status Quo

Recurring Costs - Expense Item(s) 1 2 3

For Proposed Alternative

Recurring Costs - Expense Item(s) 4 5 6 7 8
Investment Costs - Expense Item(s) 1 2 3

L I F E C Y C L E C O S T R E P O R T PAGE 005

ALTERNATIVE 3: Commercial Off-The-Shelf Package (COTS)

YEAR	Acquisition Cost (01)	Develop Data Interfaces (02)	System Deployment (03)	Hotline Support (04)	Software Maintenance (05)
1999	$1,798,000	$89,000	$0	$0	$0
2000	$0	$47,000	$260,000	$0	$0
2001	$0	$0	$0	$7,530	$6,250
2002	$0	$0	$0	$7,530	$6,250
2003	$0	$0	$0	$7,530	$6,250
2004	$0	$0	$0	$7,530	$6,250
2005	$0	$0	$0	$7,530	$6,250
%NPV	68.53	5.14	9.67	1.30	1.08
	$1,775,938	$133,199	$250,546	$33,711	$27,981
DISCOUNTING CONVENTION	M-O-Y	M-O-Y	M-O-Y	M-O-Y	M-O-Y

YEAR	Database Maintenance (06)	Project Admin. (07)	Software Upgrades (08)	TOTAL ANNUAL OUTLAYS	MIDDLE OF YEAR DISCOUNT FACTORS
1999	$0	$0	$0	$1,887,000	0.988
2000	$12,000	$4,500	$0	$323,500	0.964
2001	$6,000	$3,200	$0	$22,980	0.940
2002	$6,000	$3,200	$0	$22,980	0.917
2003	$6,000	$3,200	$350,000	$372,980	0.895
2004	$6,000	$3,200	$0	$22,980	0.873
2005	$6,000	$3,200	$0	$22,980	0.852
%NPV	1.48	0.72	12.08		
	$38,425	$18,661	$313,192		
DISCOUNTING CONVENTION	M-O-Y	M-O-Y	M-O-Y		

L I F E C Y C L E C O S T R E P O R T PAGE 006

ALTERNATIVE 3: Commercial Off-The-Shelf Package (COTS)

YEAR	PRESENT VALUE	CUMULATIVE NET PRESENT VALUE
1999	$1,863,846	$1,863,846
2000	$311,737	$2,175,583
2001	$21,604	$2,197,187
2002	$21,078	$2,218,265
2003	$333,755	$2,552,020
2004	$20,062	$2,572,082
2005	$19,571	$2,591,653

EQUIVALENT UNIFORM ANNUAL COST = $403,164 (2.50% DISCOUNT RATE, 7 YEARS)

L I F E C Y C L E C O S T R E P O R T PAGE 007

PRIMARY ECONOMIC ANALYSIS

Present Alternative: Status Quo: 70 Diffe
Proposed Alternative: Commercial Off-The-Shelf Package (COTS)

Project Year(s)	Recurring Annual Operating Costs Present Alternative	Recurring Annual Operating Costs Proposed Alternative	Differential Cost	Present Value Factor	Present Value of Differential Cost
1999	$638,400	$0	$638,400	0.988	$630,566
2000	$638,400	$16,500	$621,900	0.964	$599,287
2001	$638,400	$22,980	$615,420	0.940	$578,579
2002	$638,400	$22,980	$615,420	0.917	$564,465
2003	$638,400	$22,980	$615,420	0.895	$550,699
2004	$638,400	$22,980	$615,420	0.873	$537,267
2005	$638,400	$22,980	$615,420	0.852	$524,165
Totals	$4,468,800	$131,400	$4,337,400		$3,985,028

Total present value of investment	$2,472,875
Plus: present value of existing assets to be used	$0
Less: present value of existing assets replaced	$0
Less: present value of terminal value of alternative	$0
Total present value of net investment	$2,472,875
Total present value of differential costs	$3,985,028
Plus: present value of cost of refurbishment or modification eliminated	$0
Less: status quo salvage value	$0
Total present value of savings	$3,985,028
Savings/Investment ratio	1.61
Discounted Payback Period	4.2 years

For Status Quo

Recurring Costs - Expense Item(s) 1 2 3

For Proposed Alternative

Recurring Costs - Expense Item(s) 4 5 6 7
Investment Costs - Expense Item(s) 1 2 3 8

L I F E C Y C L E C O S T R E P O R T PAGE 008

ALTERNATIVE 4: ULTIMA in C++

YEAR	Software Development (01)	Develop Data Interfaces (02)	System Deployment (03)	Hotline Support (04)	Software Maintenance (05)
1999	$950,000	$42,000	$0	$0	$0
2000	$225,000	$42,000	$150,000	$0	$0
2001	$0	$0	$0	$6,500	$5,980
2002	$0	$0	$0	$6,500	$5,980
2003	$0	$0	$0	$6,500	$5,980
2004	$0	$0	$0	$6,500	$5,980
2005	$0	$0	$0	$6,500	$5,980
%NPV	43.71	3.10	5.47	1.10	1.01
	$1,155,162	$81,958	$144,546	$29,100	$26,772
DISCOUNTING CONVENTION	M-O-Y	M-O-Y	M-O-Y	M-O-Y	M-O-Y

YEAR	Software Enhancements (06)	Database Maintenance (07)	Project Admin. (08)	TOTAL ANNUAL OUTLAYS	MIDDLE OF YEAR DISCOUNT FACTORS
1999	$0	$0	$0	$992,000	0.988
2000	$45,677	$12,000	$4,500	$479,177	0.964
2001	$115,000	$6,000	$3,200	$136,680	0.940
2002	$115,000	$6,000	$3,200	$136,680	0.917
2003	$340,000	$6,000	$3,200	$361,680	0.895
2004	$340,000	$6,000	$3,200	$361,680	0.873
2005	$340,000	$6,000	$3,200	$361,680	0.852
%NPV	43.45	1.45	0.71		
	$1,148,261	$38,425	$18,661		
DISCOUNTING CONVENTION	M-O-Y	M-O-Y	M-O-Y		

L I F E C Y C L E C O S T R E P O R T PAGE 009

ALTERNATIVE 4: ULTIMA in C++

YEAR	PRESENT VALUE	CUMULATIVE NET PRESENT VALUE
1999	$979,828	$979,828
2000	$461,754	$1,441,582
2001	$128,498	$1,570,080
2002	$125,364	$1,695,444
2003	$323,643	$2,019,087
2004	$315,751	$2,334,838
2005	$308,047	$2,642,885

EQUIVALENT UNIFORM ANNUAL COST = $411,134 (2.50% DISCOUNT RATE, 7 YEARS)

L I F E C Y C L E C O S T R E P O R T PAGE 010

PRIMARY ECONOMIC ANALYSIS

Present Alternative: Status Quo: 70 Diffe
Proposed Alternative: ULTIMA in C++

Project Year(s)	Recurring Annual Operating Costs Present Alternative	Proposed Alternative	Differential Cost	Present Value Factor	Present Value of Differential Cost
1999	$638,400	$0	$638,400	0.988	$630,566
2000	$638,400	$62,177	$576,223	0.964	$555,271
2001	$638,400	$136,680	$501,720	0.940	$471,685
2002	$638,400	$136,680	$501,720	0.917	$460,179
2003	$638,400	$361,680	$276,720	0.895	$247,619
2004	$638,400	$361,680	$276,720	0.873	$241,578
2005	$638,400	$361,680	$276,720	0.852	$235,689
Totals	$4,468,800	$1,420,577	$3,048,223		$2,842,587

Total present value of investment	$1,381,666
Plus: present value of existing assets to be used	$0
Less: present value of existing assets replaced	$0
Less: present value of terminal value of alternative	$0
Total present value of net investment	$1,381,666
Total present value of differential costs	$2,842,587
Plus: present value of cost of refurbishment or modification eliminated	$0
Less: status quo salvage value	$0
Total present value of savings	$2,842,587
Savings/Investment ratio	2.06
Discounted Payback Period	2.4 years

For Status Quo

Recurring Costs - Expense Item(s) 1 2 3

For Proposed Alternative

Recurring Costs - Expense Item(s) 4 5 6 7 8
Investment Costs - Expense Item(s) 1 2 3

L I F E C Y C L E C O S T R E P O R T PAGE 011

SOURCE AND DERIVATION OF COSTS AND BENEFITS:

STATUS QUO: 70 DIFFERENT SYSTEMS

1. Database Maintenance. Includes all trouble-shooting and database integration. Approx. 480 hrs.per year @ $25/hr = $12,000/yr.

2. Project Administration. Includes day-to-day admininstration of the current operations. Approx. 427 hrs/yr @ $15/hr = $6,400/yr.

3. Operations Support. Includes all transferring and relaying of data into the databases; all organization and retrieval of data files; all upkeep and trouble-shooting of system. 8 programmers @ $65,000/yr + 2 technicians @ $50,000/yr = $620,000/yr.

SOURCE: Pro Data Processors, 1998-1999 contract.

ALTERNATIVE 2: ULTIMA IN ADA

1. Software Development. 8 Programmers (@ $100,000/yr salary) x 15 mths = $1,000,000.

2. Develop Data Interfaces. Includes all work for Corps database interface capability. 1 Ada Programmer (@ 35,000/yr salary) x 2 years = $70,000.

3. System Deployment. Includes all loading, installation, materials, and hook-up for the Corps and other required points-of-contact. 1,000 workstations $150/workstation = $150,000.

4. Hotline Support. Flat-rate fee for limited hotline support: 3 minute max. for calls - installation problems, bugs, etc. Application features not covered.

5. Software Maintenance. Estimated number of hours for maintenance per year is200. 200 x $27/hr (maint. rate) = $5,300.

6. Software Enhancements. Enhancements must be done to accommodate mandated functionality and Corps system expansion. Some enhancements are needed in deployment year 2000: 1 programmer @ $59,333/yr x 7.6 months = $37,679. Years 2001, 2002: 2 programmers ($59,333/yr each) x 10.37 months = $102,542. Years 2003-2005: 5 programmers ($59,333/yr each) x 11 months = $272,753.

7. Database Maintenance. Includes all trouble-shooting and database integration. Approx. 480 hrs. @ $25/hr = $12,000 for 1st year. Subsequent years: 240 hrs. @ $25/hr = $6,000.

8. Project Administration. Includes day-to-day administration of the system. Approx. 300 hours @ $15/hr = $4,500 for the 1st year. Subsequent years: 213 hours @ $15/hr = $3,200.

SOURCE: All Costs and Schedules taken from an average of 3 contractor estimates: Divine Software Developers, Technologies, Inc., and Systems-R-Us.

L I F E C Y C L E C O S T R E P O R T PAGE 012

SOURCE AND DERIVATION OF COSTS AND BENEFITS (cont.):

ALTERNATIVE 3: COMMERCIAL-OFF-THE-SHELF

1. Acquisition Cost for FundCruncher, Plus. Includes an unlimited site license for Corps use. The government does not own the code. $1,798,000.

SOURCE: Average of 5 1999-2000 GSA price lists.

2. Data Interfaces. Includes all work for Corps database interface capability. 2 programmers @$44,500/yr each x 18.3 months = $136,000.

SOURCE: Taken from an average of 3 contractor estimates: Divine Software Developers, Technologies, Inc., and Systems-R-Us.

3. System Deployment. Includes all loading, installation, materials, and hook-up for the Corps and other required points-of-contact. Also requires extra peripherals. 1000 workstations @ $260/workstation = $260,000. Deployment will be completed in 12 months.

SOURCE: Taken from an average of 3 contractor estimates: Divine Software Developers, Technologies, Inc., and Systems-R-Us.

4. Hotline Support. Flat-rate fee for hotline support: No time limit for calls - installation problems, bugs, etc. Application features covered.

SOURCE: MacroFirm's 1999-2000 GSA price list estimate.

5. Software Maintenance. Estimate number of hours per year is 196. $27/hr x 196 = $5,300.

SOURCE: Taken from an average of 3 contractor estimates: Divine Software Developers, Technologies, Inc., and Systems-R-Us.

6. Software Upgrades. Upgrades needed to accommodate system expansion. Scheduled release date 2003. Purchase price = $350,000.

SOURCE: MacroFirm's 1999-2000 GSA price list estimate.

7. Database Maintenance. Includes all trouble-shooting and database integration. Approx. 480 hrs. @ $25/hr = $12,000 for 1st year. Subsequent years: 240 hrs. @ $25/hr = $6,000.

SOURCE: Taken from an average of 3 contractor estimates: Divine Software Developers, Technologies, Inc., and Systems-R-Us.

8. Project Administration. Includes day-to-day administration of the system. Approx. 300 hours @ $15/hr = $4,500 for the 1st year. Subsequent years: 213 hours @ $15/hr = $3,200.

SOURCE: Taken from an average of 3 contractor estimates: Divine Software Developers, Technologies, Inc., and Systems-R-Us.

L I F E C Y C L E C O S T R E P O R T PAGE 013

SOURCE AND DERIVATION OF COSTS AND BENEFITS (cont.):

ALTERNATIVE 4: ULTIMA IN C++

1. Software Development. 8 C++ Programmers (@ $118,750,/yr salary) x 14.8 mths = $1,175,000.

2. Data Interfaces. Includes all work for Corps database interface capability. 1 C++ Programmer (@ $42,000/yr salary) x 24 months = $84,000.

3. System Deployment. Includes all loading, installation, materials, and hook-up for the Corps and other required points-of-contact. 1000 workstations @ $150/workstation = $150,000.

4. Hotline Support. Flat-rate fee for limited hotline support: 3 minute max. for calls - installation problems, bugs, etc. Application features not covered.

5. Software Maintenance. Estimated number of hours for maintenance per year is 221. 221 x $27/hr (maint. rate) = $5,980.

6. Software Enhancements. Enhancements must be done to accommodate mandated functionality and Corps system expansion. Some enhancements are needed in deployment year 2000: 1 programmer @ $59,333/yr x 9.2 months = $45,677. Years 2001, 2002: 2 programmers ($59,333/yr each) x 11.6 months = $115,000. Years 2003-2005: 6 programmers ($59,333/yr each) x 11.5 months = $340,000.

7. Database Maintenance. Includes all trouble-shooting and database integration. Approx. 480 hrs. @ $25/hr = $12,000 for 1st year. Subsequent years: 240 hrs. @ $25/hr = $6,000.

8. Project Administration. Includes day-to-day administration of the system. Approx. 300 hours @ $15/hr = $4,500 for the 1st year. Subsequent years: 213 hours @ $15/hr = $3,200.

SOURCE: All Costs and Schedules taken from an average of 3 contractor estimates: Divine Software Developers, Technologies, Inc., and Systems-R-Us.

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                C O S T   S E N S I T I V I T Y   A N A L Y S I S      PAGE 001

COST SENSITIVITY ANALYSIS NUMBER ..... 01
TITLE ..... Ada vs. C++: Ada Software
                                       Enhancements
ALLOWABLE CHANGE ..... 200.00 PERCENT

This sensitivity analysis checks for alternative  4 to be ranked least cost as
a result of changes in the expense item(s) listed below:

    ALTERNATIVE                EXPENSE ITEM(S)
    -----------                ---------------
     2 - ULTIMA in Ada          6 - Software    Enhancements

     4 - ULTIMA in C++         ** NOTHING CHANGED **


The selected expense items are allowed to vary from a value of 100% less than
their input value to 200.00% more than their input value.

    ALTERNATIVE                NET PRESENT VALUE
    -----------                -----------------
     2 - ULTIMA in Ada                $2,246,927
     4 - ULTIMA in C++                $2,642,885

For alternative  4 to be ranked least cost, increase the selected expense
item(s) by more than 42.07%.
```

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                C O S T  S E N S I T I V I T Y  A N A L Y S I S  1     PAGE 002

                     Graph of NPV vs. % change in expense items

                 =+=========+=========+=========+=========+=========+=========+=
           4135 -                                                             2-
                I                                                          22 I
                I                                                        2   I
                I                                                     22     I
           3852 -                                                   2       -
                I                                                 22         I
                I                                               2            I
                I                                            22              I
A          3569 -                                          2                  -
C               I                                       22                    I
T               I                                    2                        I
U               I                                 22                          I
A          3286 -                              2                              -
L               I                           22                                I
                I                        2                                    I
                I                     22                                      I
D          3003 -                   2                                        -
O               I                22                                          I
L               I             2                                              I
L               I          22                                                I
A          2720 -        2                                                   -
R               I444444444444444444444444444MM4444444444444444444444444444I
S               I                        2                                  I
                I                     22                                    I
           2437 -                  2                                       -
                I                22                                         I
                I              2                                            I
                I           22                                              I
           2154 -         2                                                 -
                I      22                                                   I
                I    2                                                      I
                I  22                                                      I
           1871 -2                                                         -
                I                                                          I
                I                                                          I
                I                                                          I
           1588 -                                                          -
                I                                                          I
                I                                                          I
                I                                                          I
           1305 -                                                          -
                =+=========+=========+=========+=========+=========+=========+=
                -100.00    -50.00       .00     50.00    100.00    150.00    200.0

                                % CHANGE IN EXPENSE ITEMS

                   LEGEND   DESCRIPTION
                   ------   -----------
                   2        ULTIMA in Ada
                   4        ULTIMA in C++
                   M        MERGING DATA
```

C O S T S E N S I T I V I T Y A N A L Y S I S PAGE 003

COST SENSITIVITY ANALYSIS NUMBER 02
TITLE ..... Ada vs. COTS: Ada Software Enhancements
ALLOWABLE CHANGE ..... 200.00 PERCENT

This sensitivity analysis checks for alternative 3 to be ranked least cost as a result of changes in the expense item(s) listed below:

ALTERNATIVE	EXPENSE ITEM(S)
2 - ULTIMA in Ada	6 - Software Enhancements
3 - Commercial Off-The-S	** NOTHING CHANGED **

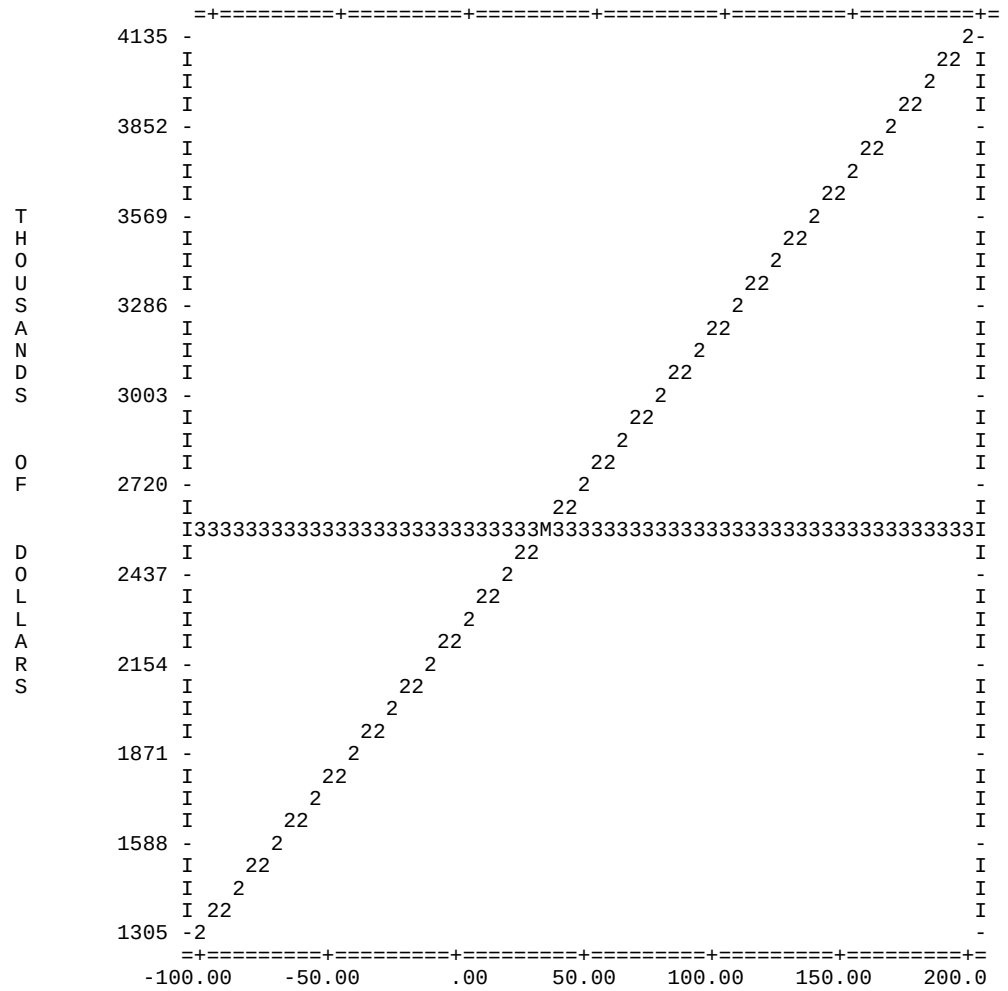
The selected expense items are allowed to vary from a value of 100% less than their input value to 200.00% more than their input value.

ALTERNATIVE	NET PRESENT VALUE
2 - ULTIMA in Ada	$2,246,927
3 - Commercial Off-The-S	$2,591,653

For alternative 3 to be ranked least cost, increase the selected expense item(s) by more than 36.62%.

C O S T S E N S I T I V I T Y A N A L Y S I S 2 PAGE 004

Graph of NPV ($ in thousands) vs. % change in expense items



```
D I S C O U N T  R A T E  S E N S I T I V I T Y  A N A L Y S I S  1   PAGE 001

         Graph of Net Present Value ($ in thousands) vs. Discount Rate

     =+===========+===========+===========+===========+===========+=
4190 -1111111                                                      -
     I       111111111111111                                       I
     I                     11111111111111                          I
     I                                  111111111111111            I
3992 -                                                             -
     I                                                             I
     I                                                             I
     I                                                             I
3794 -                                                             -
     I                                                             I
     I                                                             I
     I                                                             I
3596 -                                                             -
     I                                                             I
     I                                                             I
     I                                                             I
3398 -                                                             -
     I                                                             I
     I                                                             I
     I                                                             I
3200 -                                                             -
     I                                                             I
     I                                                             I
     I                                                             I
3002 -                                                             -
     I                                                             I
     I                                                             I
     I                                                             I
2804 -                                                             -
     I                                                             I
     I4444                                                         I
     I    444444444444444444444444444                              I
2606 -33333333333333333333333333333MMMMMM4444444444444            -
     I                                      3333333333333          I
     I                                                             I
     I                                                             I
2408 -                                                             -
     I                                                             I
     I                                                             I
     I222222222222222222222222222222222                           I
2210 -                                   22222222222222222         -
     =+===========+===========+===========+===========+===========+=
     1.87        2.17        2.47        2.77        3.07        3.3

                       DISCOUNT RATE (%)

        LEGEND   DESCRIPTION              LEGEND   DESCRIPTION
        ------   -----------              ------   -----------
        1        Status Quo: 70 Diffe     M        MERGING DATA
        2        ULTIMA in Ada
        3        Commercial Off-The-S
        4        ULTIMA in C++
```

D I S C O U N T R A T E S E N S I T I V I T Y A N A L Y S I S 1 PAGE 002

Summary of Alternative Rankings by Discount Rate

Discount Rate: 2.50 Lower Limit: 1.88 Upper Limit: 3.13

Discount Rate (%)	Alternative Ranking
1.88	2 3 4 1
1.98	2 3 4 1
2.08	2 3 4 1
2.18	2 3 4 1
2.28	2 3 4 1
2.38	2 3 4 1
2.48	2 3 4 1
2.50	2 3 4 1
2.58	2 3 4 1
2.68	2 3 4 1
2.78	2 3 4 1
2.88	2 3 4 1
2.98	2 3 4 1
3.13	2 3 4 1

* indicates a change in the alternative ranking occurred.

D I S C O U N T R A T E S E N S I T I V I T Y A N A L Y S I S 1 PAGE 003

Table of Net Present Value for each Discount Rate

Discount Rate = 1.88%			Discount Rate = 1.98%			Discount Rate = 2.08%		
Alt	-	NPV	Alt	-	NPV	Alt	-	NPV
2	-	$2,283,552	2	-	$2,277,560	2	-	$2,271,602
3	-	$2,611,655	3	-	$2,608,397	3	-	$2,605,152
4	-	$2,686,801	4	-	$2,679,615	4	-	$2,672,470
1	-	$4,189,681	1	-	$4,175,634	1	-	$4,161,658

Discount Rate = 2.18%			Discount Rate = 2.28%			Discount Rate = 2.38%		
Alt	-	NPV	Alt	-	NPV	Alt	-	NPV
2	-	$2,265,676	2	-	$2,259,782	2	-	$2,253,920
3	-	$2,601,918	3	-	$2,598,695	3	-	$2,595,486
4	-	$2,665,363	4	-	$2,658,297	4	-	$2,651,267
1	-	$4,147,765	1	-	$4,133,946	1	-	$4,120,202

Discount Rate = 2.48%			Discount Rate = 2.50%			Discount Rate = 2.58%		
Alt	-	NPV	Alt	-	NPV	Alt	-	NPV
2	-	$2,248,093	2	-	$2,246,927	2	-	$2,242,289
3	-	$2,592,294	3	-	$2,591,653	3	-	$2,589,107
4	-	$2,644,283	4	-	$2,642,885	4	-	$2,637,324
1	-	$4,106,531	1	-	$4,103,806	1	-	$4,092,934

Discount Rate = 2.68%			Discount Rate = 2.78%			Discount Rate = 2.88%		
Alt	-	NPV	Alt	-	NPV	Alt	-	NPV
2	-	$2,236,522	2	-	$2,230,785	2	-	$2,225,081
3	-	$2,585,939	3	-	$2,582,778	3	-	$2,579,631
4	-	$2,630,409	4	-	$2,623,534	4	-	$2,616,693
1	-	$4,079,414	1	-	$4,065,964	1	-	$4,052,590

D I S C O U N T R A T E S E N S I T I V I T Y A N A L Y S I S 1 PAGE 004

Table of Net Present Value for each Discount Rate

Discount Rate = 2.98%			Discount Rate = 3.13%		
Alt	-	NPV	Alt	-	NPV
2	-	$2,219,401	2	-	$2,210,946
3	-	$2,576,497	3	-	$2,571,820
4	-	$2,609,891	4	-	$2,599,757
1	-	$4,039,286	1	-	$4,019,463